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ACHENE MORPHOLOGY OF THE GENUS *KYLLINGA* ROTTB. (CYPERACEAE) IN GOA, INDIA

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Abstract:
Achene morphology of 4 species of *Kyllinga* in Goa has been explained from taxonomic viewpoint. Achene is biconvex and laterally compressed in all the species. Silica bodies were found in all the species, but their appearance is different in different species. Buttresses is absent in all the species, except in *Kyllinga squamulata*.
Keywords: Achene morphology; Goa; Kyllinga; Scanning electron microscope; Silica bodies

Introduction

The genus *Kyllinga* is characterised by capitate inflorescence of compressed spikelets, rachilla disarticulating at base thereby spikelets falling off as a whole at maturity, stigmas 2 and laterally compressed achenes. There are 60 species of *Kyllinga* (Mabberley, 2009) distributed in warmer regions. Karthikeyan *et al.* (1989) reported 7 species from India. Including the later additions by Govindarajalu & Ramani (1994) and Wadoodkhan & Taur (2015), at present there are 11 species in India. In Goa there are 4 species (Patil, 2013).

Schuyler (1971) discussed about the cell diversity on achene surface of Cyperaceae which provides taxonomically useful information. Earlier works on micromorphology of the achenes of Indian Cyperaceae by Varma *et al.* (1989), Govindrajalu (1990), Wujek *et al.* (1992) and Menapace *et al.* (2003) are mentioned by Patil & Prasad (2016). In the present study achenes of 4 species of *Kyllinga* in Goa have been studied and their macro and micro morphology is discussed.

Materials and Methods

Achene samples were collected from the plant specimens collected from different localities in Goa and the voucher specimens are deposited in BSI. Mature achenes were selected and the morphological features were studied using stereo microscope and by interpreting the Scanning Electron Microscope (SEM) images. The shape and size of the achenes of each species were recorded and the micro-structure of the achene surface was studied using SEM images. For this, achenes were extracted from the spikelets and mounted on glass slides with sticky tape, mounted on SEM stubs and then sputter coated with platinum and examined under JOEL JSM6360 Scanning Electron Microscope. The images were then photographed at different magnifications. The SEM images of achenes of different species thus, obtained were then interpreted with the help of relevant literature. Achene shape, size, its ornamentations and micro-epidermal structures such as nature of periclinal walls, anticlinal walls and silica bodies were studied to find out the similarities or dissimilarities.

Results and Discussion

The laterally compressed achene with one angle facing the rachilla of the spikelet is a distinguishing feature to separate *Kyllinga* from the allied genus *Cyperus*. All the species possesses biconvex achene, but the size varies, especially in width. Shape of the achene varies as oblong (*K. bulbosa*), oblong or oblong-obovate (*K. nemoralis*), obovate or elliptic (*K. brevifolia*) and broadly elliptic-oblong (*K. squamulata*). All are apiculate at apex and usually with persistent style in *K. squamulata*. Colour of the achene varies from yellowish-brown to dark brown. The largest achene was found in *K. squamulata* (1.73–1.8 x 1–1.05 mm) and the smallest in *K. bulbosa* (1–1.3 x 0.42–0.6 mm). Important findings of the study is provided in table 1 and the SEM images of the achenes are shown in figure 1(plate 1).

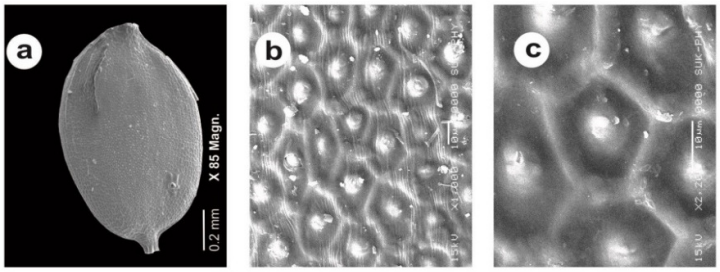
In all the 4 species achene is laterally compressed and biconvex. Only minor differences were found in its shape and size. However, as far as micromorphology is concerned, appearance of the silica bodies was found to be different in different species. In *K. brevifolia* silica bodies with blunt end are found at the centre of smooth and flat periclinal wall. Mesa-shaped silica bodies are found on smooth and convex periclinal wall of the epidermal cells in *K. bulbosa*, and in *K. nemoralis* silica bodies are smaller, spherical and arranged in longitudinal rows on smooth and flat periclinal wall. In *K. squamulata* there are dome-shaped silica bodies at the centre of the smooth and flat periclinal wall. Buttresses is absent in all the species except *K. squamulata*. Anticlinal wall in the epidermal cells of the achene in *K. bulbosa* are indistinct, straight and depressed, while in

the remaining 3 species it is distinct, straight and raised. In the light of the above discussion, it is reiterated that nature of silica bodies and periclinal wall are the prominent micromorphological characters of *Kyllinga* in Goa.

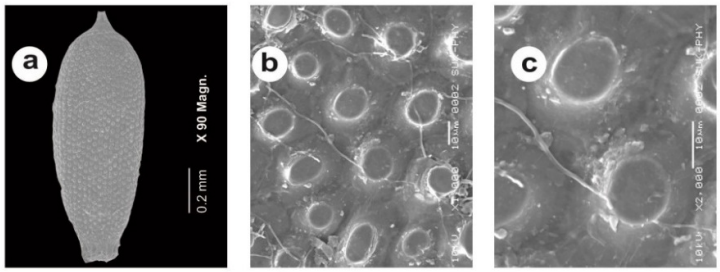
Table 1. Macro and micro morphology of achenes in the genus *Kyllinga*

Sr No	Plant name and voucher specimen	Macromorphology	Micromorphology (SEM)
1.	*Kyllinga brevifolia* Rottb. Valpoi, Sattari Taluk, North Goa, 22.9.2007 *R.T. Patil* 192666 (BSI). **PLATE 1**	Biconvex, obovate, apiculate at apex, 1–1.5 x 0.5–0.75 mm.	Epidermal cells isodaimetric pentagonal to hexagonal; anticlinal wall thick, straight, raised; periclinal wall smooth, flat, with silica bodies at the centre. Buttresses absent.
2.	*Kyllinga bulbosa* P.Beauv. Nirancarachi Rai, Sattari Taluk, North Goa, 14.11.1997, *V. Joshi & S. Rajkumar*1180 (Herbarium, Goa University). **PLATE 1**	Biconvex, oblong, apiculate at apex, 1–1.3 x 0.5-0.6 mm.	Epidermal cells isodaimetric hexagonal to polygonal; anticlinal wall indistinct, straight, depressed; periclinal wall smooth, convex, with mesa-shaped (blunt end and sloping sides) silica bodies at the centre; silica bodies appears to be in longitudinal rows. Buttresses absent.
3.	*Kyllinga nemoralis* (J.R.Forst. & G.Forst.) Dandy ex Hutch. & Dalziel Quepem, Quepum Taluk, South Goa, 22.4.2007, *R.T. Patil* 192560(BSI). **PLATE 1**	Biconvex, obovate, apiculate at apex, 1.25–1.5 x 0.5–0.8 mm.	Epidermal cells isodiametric hexagonal; anticlinal wall thick (less thick than in K. *brevifolia*), straight, raised; periclinal wall smooth, flat, with smaller spherical silica bodies at the centre in longitudinal rows. Buttresses absent.
4.	*Kyllinga squamulata* Vahl Vitthaladevi, near vitthaladevi temple, Pernem Taluk, North Goa, 19.8.2007, *R.T. Patil* 192591 (BSI). **PLATE 1**	Biconvex, broadly elliptic-oblong, apiculate at apex, 1.73–1.8 x *c.* 1 mm.	Epidermal cells isodaimetric pentagonal to hexagonal; anticlinal wall thin, straight, raised; periclinal wall smooth, flat, with dome-shaped silica bodies at the centre. Buttresses present, but less prominent.

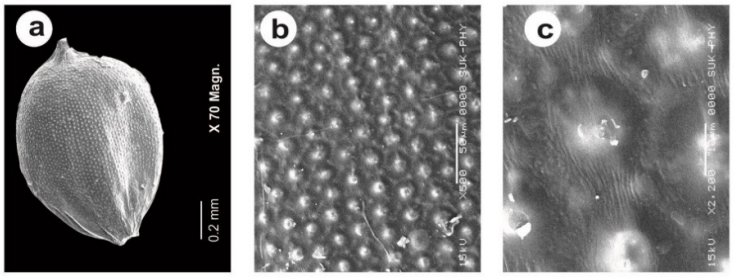
PLATE 1



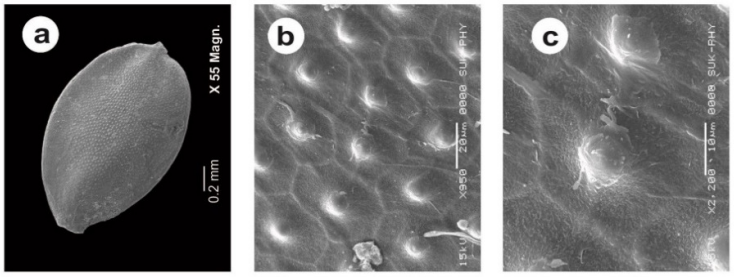
Kyllinga brevifolia Rottb. var. ***brevifolia*** - a. Achene, b & c. Epidermal cells



Kyllinga bulbosa P. Beauv. - a. Achene, b & c. Epidermal cells



Kyllinga nemoralis (J.R. Forst. & G. Forst.) Dandy ex Hutch. & Dalziel - a. Achene, b & c. Epidermal cells



Kyllinga squamulata Vahl - a. Achene, b & c. Epidermal cells

Figure 1. SEM images of the achenes in *Kyllinga* Rottb.

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References:

Govindarajalu, E. (1990): New species and Scanning electron observations in *Pycreus* sect. *muricati*. *Proc. Indian Acad. Sci.* **100**: Pp. 415-422.

Govindarajalu, E. and K. Ramani (1994): Cyperaceae Indiae Australis precursors- Two new species and one new record in *Kyllinga* Rottb. and scanning electron microscopic observations. *J. Econ. Taxon. Bot.* **18**: Pp. 335–343.

Karthikeyan, S. (1989): In: Karthikeyan S., Jain S.K., Nayar M.P. and M. Sanjappa (Eds.), *Florae Indicae Enumeratio: Monocotyledonae*. Botanical Survey of India, Kolkata. Pp. 60-61.

Mabberley, D.J. (2009): *Mabberley's Plant-Book* (3rd edition reprinted with corrections). Cambridge University Press, Cambridge. p. 460.

Menapace, F.J., Wujek, D.E. and B.H.M. Nijalingappa (2003): Achene micromorphology of some Indian Cyperaceae. V. Achene micromorphology as a possible systematic aid to the taxonomic recognition of *Fimbristylis* sections. *Bull. Bot. Surv. India* **45**: Pp. 21–28.

Patil, R.T. (2013): *Taxonomic studies on family Cyperaceae in Goa with added emphasis on nut morphology*. Unpublished Ph.D. thesis, University of pune, Pune.

Patil, R.T. and V.P. Prasad (2016). Achene morphology and its taxonomic significance in Cyperaceae of Goa, India: 1. Genus *Fimbristylis*. *Indian J. Plant Sci.* 5(1): 87-96.

Schuyler, A.E. (1971): Scanning electron microscopy of achene epidermis in species of *Scirpus* (Cyperaceae) and related genera. *Proc. Acad. Nat. Sci. Philadelphia* **123**: Pp. 29-52.

Varma, S.K., Pandey, A.K. and AK Sinha (1989): Epidermal surface patterns of achene in

Eleocharis R. Br. (Cyperaceae). *Curr. Sci.* **58**: Pp. 1374-1377.

Wadood Khan, M.A. and R.D. Taur (2015): In: Wadood Khan, M.A. *Cyperaceae Western Ghats, West Coast and Maharashtra*. Datsons, Nagpur. p. 274.

Wujek, D.E., Varma, S.K. and R.A. Ruhlman (1992): Achene micromorphology of some Indian Cyperaceae (*Cyperus*, *Fimbristylis*, *Pycreus*, *Scirpus*, and *Scleria*). *Asian J. Plant Sci.* **4**: Pp. 1-19.